the appearance in 1871 could in no way be included under the general formula, without admitting that the resisting medium had ceased to operate, or that the comet during the revolution immediately preceding had undergone a sudden retardation through the intervention of some unknown force. Following up at first the latter hypothesis, he was able to assign approximately the time when such perturbation must have taken effect, and found that at this time the comet was traversing the region of the small planets between Mars and Jupiter. This circumstance led Asten to conjecture that the attraction of one of these bodies, which the comet had encountered, might have occasioned the retardation.

A similar retardation was indicated again by the last appearance of the comet in 1881, and, following a similar method, Dr. Backlund was able to fix the time and the approximate place, which was again found to be in the midst of the zone of small planets. Thus, as M. Otto Struve remarks in his report upon Dr. Backlund's memoir, there was reason to think that we were upon the traces of a very interesting discovery, which added much to the interest attaching to his new researches on the last four appearances of the comet, as a complement to the investigations of Asten for the period 1819–1868. This additional work has not, however, led to a confirmation of the above-named hypothesis, but has replaced it by results of a more positive character and of greater scientific importance.

Dr. Backlund had found, on following rigorously the rules of calculation adopted by his predecessor, that the last four appearances, and particularly those of 1871 and 1881, could not be represented without admitting that the acceleration had diminished considerably, and had even disappeared for the last two returns. But on a closer examination it was discovered that a strange error had entered into the combination of the appearance of 1868 with the two preceding ones; in one of these revolutions where the observations made after perihelion were combined with those made before the succeeding one, Asten, though he supposed he had taken into account the resistance, had in fact not done so. This being rectified, the errors of 1871 and 1881, which amounted to many minutes, were destroyed in great measure, and the discordances reduced to tolerable though still unsatisfactorily large quantities. After a revision of the formulæ employed, Dr. Backlund succeeded in reducing the probable error remaining in each co-ordinate of a normal position to 4″·1. The introduction of the mass of Jupiter, according to the determination of Bessel-Schur, further reduced this probable error to 2″·8, assigning for the acceleration during the period in question 0″·054 for each entire revolution, and M. Struve considers that Dr. Backlund's researches have thus put us in possession of a theory of the comet for its later returns which leaves little or nothing to be desired.

It has been mentioned that for the period 1819-1868 the probable error in the normal positions given by Asten amounted to 9″·0. Partly, perhaps, the larger error is attributable to the inferiority of the instrumental means available in the first half of the century, but probably in a greater degree to imperfections detected in the theory adopted for this earlier period, upon which M. Struve's report enters into some detail. For this reason Dr. Backlund has charged himself with the construction of a new theory for the interval 1819-1868, in which he will be much assisted by the earlier work of Asten, described as having been left in admirable order, and thus admitting of being followed and verified at every step.

While awaiting the results of these further investigations, M. Struve draws attention to a very singular fact, which will not be affected by them. He remarks there is no reason to doubt that the acceleration has much diminished in the interval between the mean epochs of the two periods referred to above. He asks: Is it that the volume of the comet has diminished in the interval? The observations afford no trace of such diminution. Or again,—has the matter of which the comet is composed been increased? On this we can say nothing. There is, further, the supposition that the so called resisting medium has altered in density, or again, that the acceleration attributed to the effect of a resisting medium is produced by forces of a totally different nature.

All this for the moment must remain enigmatical, but the fact is established that the acceleration has diminished; we cannot say whether this diminution has been produced instantaneously or gradually; it is a point upon which the new researches undertaken by Dr. Backlund may enlighten us.

Encke's comet returns to perihelion in March, 1885.

GEOGRAPHICAL NOTES

THE eleventh number, 1883, of Petermann's *Geographische Mittheilungen* opens with a minute account of the archipelago of Chiloe, by Dr. C. Martin, who in former numbers of the *Mittheilungen*, in the *Revista cientifica de Chile*, and in other publications, has already communicated important information on this part of the earth's surface. The present contribution has special reference to vol. viii., recently published at Santiago, of the *Anuario de la Marina de Chile*. The next article gives an interesting sketch of the progress of the knowledge of Kafiristan by Europeans from 1829, when it first became known to Elphinstone, down to the present year, when Mr. McNair, the Indian Government surveyor, penetrated as far as the Dorah Pass; and an account of the present state of the inhabitants ethnographically, ethologically, socially, morally, and religiously, according to the reports of the Rev. Mr. Hughes and other recent visitors. The third article traces the route of the Russian Embassy of 1878-79 through Afghanistan and the Khanate of Bukhara, following the descriptions of Dr. J. Jaworski, member of the Russian Geographical Society, who as physician accompanied the Embassy, and has recently published an account of the expedition in two thick octavo volumes in Russian. In a long paper illustrated by a map by Bruno Hassenstein, which also embraces Dr. Junker's expedition through those parts, Dr. Emin-Bey prosecutes his travels to the west of the Bahr-el-Jebel in October and November of last year. Starting from Bedden, on the White Nile, on October 9, he penetrated south-westwards as far as Janda, the extreme southern post in the Kakuák country, whence he proceeded north-westwards through the Fadjelu Land, the station Kabajendi, the region of the Makraka and of the Abuka, as far as the station of Gosa. From this point Dr. Emin-Bey turned south-eastwards through the Abukaja country, and the Makraka-Ssgaïre stations, and on November 26 arrived at the station of Wandi. The Makraka are described as a people dowered, both men and women, with a remarkable profusion of hair, which by means of fat, the sap of trees, &c., they studiously arrange in plaits, pigtails, &c., producing very surprising effects. The name Makraka, though now universally applied to the people of that region, was, it appears, not the original name, but, signifying cannibals, was at first used by the natives to designate a body of invaders of the Iddo race from the south. Dr. K. Zöppritz, in the next following article, discusses Dr. Emin-Bey's measurements of heights and atmospherical pressure at Lado.

WE have also received the *Mittheilungen* of the Geographical Society in Hamburg for 1880–81. It contains a very copious account of the Island of Chios (or Scio) geographically, geologically, ethnologically, and commercially; a lecture on the cola-nut, delivered before the Geographical Society of Hamburg on January 5 of last year, and an instructive description of the "sacred" Japanese town of Kioto. Next follows a very careful and comprehensive account in 250 pages, by Dr. H. Siegler-schmidt, of the results of the North Polar expeditions of this century. After summing up our knowledge of the North Polar regions in the year 1818, the review traces the history of North Polar investigation since that date, taking stock, in particular, of our knowledge of East Greenland, Spitzbergen, the Siberian glacial sea, and other hyperborean tracts. Lastly, it draws up the total results down to the present date in respect of hydrography, meteorology, magnetism, astronomy, &c. In the next article Herr E. R. Flegel gives the first of a series of sketches intended to comprise (1) the mangrove swamps of the delta of the Niger; (2) the mountains of Cameroon; and (3) the banks of the lower Niger. In this first sketch we are introduced to the long and narrow sandy strip of land rising but little above the level of the sea, and running parallel with the coast of the Bight of Benin.

THE *Verhandlungen* of the Berlin Geographical Society, Band x., No. 7, contains a very copious article on Wisconsin; and the *Zeitschrift* of the same society, No. 105, gives the conclusion of Dr. Richthofen's account of his travels in China, as also, among other valuable papers, a contribution to the ethnography of the extreme north-east of Asia, by Herr G. Gerland.

WE have further received the *Bulletin de la Société de Géographie* for the second and third quarters of this year. An article by M. Grandidier briefly describes the province of Imerina, the central, as also the most populous and important, province of Madagascar. The province is mountainous, traversed by numerous watercourses, entirely bare of tree or shrub, or often even of cultivated plant, scarcely inhabited in the hilly grounds, but thickly peopled

in the valleys. The hills covering most of the country, of hard and compact red clay, through which blocks of granite crop largely up, are not fertile. To the west of the capital, in the very centre of the province, is a large plain, about 30 km. long by as many broad, formerly a lake or marsh, now an immense field of rice, where emerge hamlets and houses like so many islets. There is also an interesting account of the Fuegians. The fluctuations of the Indian population in the United States are discussed by M. de Semalle in an article to which M. Simonin shortly replies. The kingdom of Perak, the Peninsula of Malacca, is described by M. De La Croix. Commandant Gallieni, of the French Naval Infantry, furnishes a mass of information on the races and populations of the Upper Niger, while Dr. Audray relates at considerable length his personal impressions and reminiscences of Hué during the eighteen months he passed there at the French Legation. M. Fernandez also communicates a paper on the Argentine Republic.

THE *Bulletin of the American Geographical Society* has a paper on the Philippine Islands by Dr. Kneeland, and another on the currents of the Pacific Ocean, by Dr. Antisell.

IN an article in the last number of the *Bremen Geographical Journal* on the inhabitants of the Chukche Peninsula, in the north-east extremity of Asia, Dr. Aurel Krause, after a brief sketch of voyages of discovery and scientific expeditions to that region, sums up the views of the different authorities with reference to the population of the peninsula, and endeavours to reconcile and supplement them with immediate observations of his own. As the result of his studies he distinguishes two different races on the peninsula—the Chukches and the Eskimo. The Chukches, again, are either nomadic or settled. The nomadic Chukches, who are also distinguished by the possession of reindeer, are scattered over the country to the west of Behring Strait, as far as Chaun Bay and the sources of the Great and Little Anjui, and south to the Anadyr River, some 5000 (German) square miles of land, with a population hardly numbering over 2000. The settled Chukches dwell on the shores of the Arctic Ocean from Chaun Bay to Behring Straits, and in some spots on the east coast in villages counting up to forty huts. There is also a third class of Chukches, intermediary between the aristocratic reindeer proprietors and the fishers, a class of merchants. A different race, looked down upon by the Chukches, occupy the south coast from Point Chaplin (or Indian Point) to Anadyr, as also parts of the east coast. That these are of the same race as the Eskimo of the opposite American coast their mode of living, their language, and bodily structure testify beyond all doubt, according to Herr Krause, his opinion on this point differing from that of the *Vega* staff. According to Dall these Eskimo are slowly drifting southwards towards Kamtschatka. The Eskimo on the Asiatic side of Behring Straits, including those of St. Lawrence Island and of the Diomedes Islands, should hardly exceed 2000. An ethnographical map and a list of Chukche and Eskimo words in connection with the Chukche Peninsula are appended to this valuable paper.

DR. EMIL RIEBECK of Halle, the well-known traveller, is preparing for a second African journey, which will be directed to the Niger. He will be accompanied by the naturalist Herr G. A. Krause, well known as an excellent linguist and mathematician.

THE NOVEMBER MEETING OF THE NATIONAL ACADEMY OF SCIENCES[1]

FOR the first time in nineteen years, and the second time in its history, the National Academy held its mid-year meeting in New Haven, November 13–16. Thirty-three of the ninety-three members were in attendance, and during its four days' session twenty papers were presented.

The meeting was conspicuous for the discussion which most of the papers called forth, and for the general participation of the members in these discussions. It was interesting also, for the report of the committee on the solar eclipse of last May, which included the detailed reports of the expedition to Caroline Island, undertaken under the auspices of the Academy, by the principal participants, Profs. Holden and Hastings. It will further be remembered by the members from other cities for the marked hospitalities they received at the hands of their *confrères* of New Haven, and for its many social pleasures, culminating in the brilliant public reception given them by the president, Prof. Marsh, at his residence. The new buildings recently finished, or in process of erection, for the furtherance of scientific research and instruction in Yale College, were also examined with interest, together with the treasures of the Peabody Museum, where the finely-mounted collections of Profs. Verrill and E. S. Dana, and the fossil vertebrates of Prof. Marsh, called forth much admiration.

The generous discussion to which the papers gave rise was provoked at the very start by the paper of Dr. Graham Bell upon the formation of a deaf variety of the human race, which had a broad, practical interest, and which consumed the entire morning session of the first day. Mr. Bell claimed that, from purely philanthropic motives, we were pursuing a method in the education of "deaf-mutes" distinctly tending to such a result, supporting his assertions by statistics drawn from the published reports of the different institutions in this country devoted to the care of these unfortunates. They are separated in childhood from association with hearing-children, and taught what is practically a foreign language—a practice which isolates them from the rest of the community throughout their lives, and encourages their intermarriage. Such marriages were increasing at an alarming ratio, and with calamitous results. As a remedy for this danger, Dr. Bell would have the children educated in the public schools, thus bringing them into contact with hearing-children in their play, and in instruction wherever they would not be placed at a disadvantage, as in drawing and blackboard exercises. He would also entirely discard the sign-language, and cultivate the use of the vocal organs, and the reading of the lips.

The report on the solar eclipse covered a variety of topics, and will fill some hundred and fifty printed pages. In presenting it, Prof. E. S. Holden merely touched upon the principal points, and gave the leading results, in much the same form as they have already been given in this journal. The objects of the expedition were successfully carried out; and Prof. Holden regarded his special work—the search for a possible planet interior to Mercury—as proving the non-existence of the small planets reported by Profs. Watson and Swift.

Dr. C. S. Hastings read in full the greater portion of his report upon the spectroscopic work, which concluded with a critical review of the generally-received theories of the solar atmosphere, and suggested, instead, that the corona was a subjective phenomenon, largely due to the diffraction of light.

The presentation of these reports occupied the entire morning session of Wednesday, and their discussion the greater part of the afternoon session.

In criticising the current use of the word "light" in physics, Prof. Newcomb opened a long and interesting discussion. He urged that photometric measurements were comparatively valueless, because they estimate a part only of the radiant energy of the sun; whereas the quantity which should be determined was the number of ergs received per square centimetre. Prof. Langley, however, asserted that it would be impossible to estimate the radiant energy received from the stars with our present appliances; not all the stars combined would produce deflection, even in so sensitive an apparatus as the bolometer.

Another feature of marked interest was Prof. Rowland's exhibition of photographs of the solar spectrum, obtained by his new concave gratings, by which he had prepared a map of the spectrum much more detailed than heretofore secured, and free from the defects of scale found in previous photographs.

Prof. Asaph Hall communicated the results of his researches upon the mass of Saturn, based upon new measurements of the distances of the outer satellites. He determines the mass of the sun to that of Saturn to be as 1 to 1/3482.

Prof. Brewer took the occasion of the Academy's meeting in the city of his residence to exhibit samples of his experiments of many years' duration upon the subsidence of particles in liquids. They showed the action of saline and organic matter, of acids and of freezing, upon the precipitation of sediments. Most of the samples had been undisturbed for five or six years, and showed varying degrees of opalescence, resulting from the suspension of matter in the fluid.

We have mentioned only the more important papers, or those which provoked a fuller discussion than usual. The following complete list will show how largely the physical side of science predominated at the meeting. In astronomy, besides the reports on the eclipse of May 6, papers were read by A. Hall, on the mass of Saturn; by S. P. Langley, on atmospheric absorption;

[1] *Science*. From advance sheets; favoured by the Editor.